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09/997,190	11/20/2001	Richard H. Blunk	GP-301597	4053

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EXAMINER	
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ART UNIT	PAPER NUMBER
1745	

DATE MAILED: 01/16/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/997,190	Applicant(s) BLUNK ET AL.
	Examiner Dah-Wei D. Yuan	Art Unit 1745

-- The MAILING DATE of this communication appears on the cover sheet with the c rrespondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-11,13,14,16-32 is/are pending in the application.

4a) Of the above claim(s) 19-30 is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-4,6-8,11,16,17 and 32 is/are rejected.

7)☐ Claim(s) 5,9,10,13,14,18 and 31 is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.

4) ☐ Interview Summary (PTO-413) Paper No(s). _____.

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: .

LOW CONTACT RESISTANCE PEM FUEL CELL

Examiner: Yuan S.N. 09/997,190 Art Unit: 1745 January 7, 2004

Detailed Action

1. The Applicant's amendment filed on October 16, 2003 was received. Claims 12,15 were canceled. Claims 1,13,14,16,17,18 were amended. Claims 31,32 were added.

2. The text of those sections of Title 35, U.S.C. code not included in this action can be found in the prior Office Action issued on July 17, 2003.

Claim Objections

3. Claim objections on claims 1-11 are withdrawn, because claim 1 has been amended and the term "fibrillose" is understood as "having or consisting of fibrils" as defined in The American Heritage Dictionary.

4. Claims 1-4,6,11,16,17,32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cisar et al. (US 6,562,507) in view of Braun et al. (US 2002/0039675 A1).

With respect to claims 1 and 4, Cisar et al. teach a polymer electrolyte membrane (PEM) fuel cell comprising a polymer electrolyte membrane (106), ink type electrodes (108,109) formed onto the membrane, and porous gas diffusion layers (109) formed onto the electrodes. See Figure 13. The gas diffusion layer further comprises a gas diffusion matrix and a metal current collector disposed within the gas diffusion matrix, wherein the gas diffusion matrix comprises a conductive carbon fiber, conductive carbon powder and a hydrophobic bonding material. The

current collector is made by a sintered metal, such as titanium. A light coating of noble metal on the porous titanium sheets insures a long service life and stable operation even in a very corrosive environment. Gold plated stocks function well as current collectors against electrocatalyst ink decals on the fuel cell stack because of its good oxidation resistance and acid resistance. The conductivity of gold is greater than that of the titanium substrate. See Column 5, Lines 13-22; Column 6, Lines 54-65; Column 8, Line 46 to Column 9, Line 13.

However, Cisar et al. do not teach the use of a polymer composite as the substrate for the current collector. Braun et al. teach the use of a highly conductive polymer composite as the current collector in a solid polymer electrolyte membrane (PEM) type fuel cell system. They use an electrically conductive polymer composite structure in highly-corrosive environments, wherein the electrical conductivity and thermal conductivity of the resulting structure is improved as a result of enhanced filler loading capacity of the composition. Specifically, the polymer resin is combined with highly conductive filler particles. Preferably, the filler particles comprise carbon and/or graphite. The preferred composition of the polymer composite contains 45-95 wt% graphite powder, 5-50 wt% polymer resin, and 0-20 wt% metallic fiber, carbon fiber and/or carbon nanofiber. See Paragraphs 9, 20,23,27. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer composites exhibit good corrosion resistance, electrical conductivity and thermal conductivity in a highly-corrosive environment. Moreover, it is the position of the examiner that the filler particles (graphite) would inherently reside at the interface between the (hyperconductive) coating and the

polymer composite substrate, given the high concentration of the graphite filler particles (45-95 wt%) in the composite. *A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference*. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claim 2, the filler particle comprises carbon and graphite. See Paragraph 23. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which has carbon and/or graphite as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

With respect to claim 3, Braun et al. teach the filler may be provided in various forms, including particles, fibers, flakes and spheres. See Paragraph 24. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which has carbon and/or graphite particles as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

With respect to claim 6, Braun et al. teach the filler may be provided in various forms, including particles, fibers, flakes and spheres. The electrical current would flow along the general direction of the fiber-like material due to the high volume content of the filler material. See Paragraphs 24,27. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which has graphite fiber as the filler material, as the

substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

With respect to claim 11, Braun et al. teach the polymer is chosen from the group comprising polyester, phenolic and epoxy-containing resin. See Paragraph 14. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which is chosen from the group comprising polyester, phenolic and epoxy-containing resin, as the substrate of the current collector on the fuel cell of Cisar, because Braun et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

With respect to claims 16,17, it is noted that these claims are product-by-process claims. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). Since Cisar's surface coating on the conductive substrate is similar to that of the Applicant's, Applicant's process is not given patentable weight in these claims.

With respect to claim 32, Cisar et al. teach the use of noble metal coating on the conductive substrate. The coating itself is a continuous, oxidation-resistant and acid-resistant film. See Column 8, Lines 54-63.

5. Claims 1-4,6-8,11,16,17,32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cisar et al. (US 6,562,507) in view of Bisaria et al. (US 6,379,795 B1).

With respect to claims 1 and 4, Cisar et al. teach a polymer electrolyte membrane (PEM) fuel cell comprising a polymer electrolyte membrane (106), ink type electrodes (108,109) formed onto the membrane, and porous gas diffusion layers (109) formed onto the electrodes. See Figure 13. The gas diffusion layer further comprises a gas diffusion matrix and a metal current collector disposed within the gas diffusion matrix, wherein the gas diffusion matrix comprises a conductive carbon fiber, conductive carbon powder and a hydrophobic bonding material. The current collector is made by a sintered metal, such as titanium. A light coating of noble metal on the porous titanium sheets insures a long service life and stable operation even in a very corrosive environment. Gold plated stocks function well as current collectors against electrocatalyst ink decals on the fuel cell stack because of its good oxidation resistance and acid resistance. The conductivity of gold is greater than that of the titanium substrate. See Column 5, Lines 13-22; Column 6, Lines 54-65; Column 8, Line 46 to Column 9, Line 13.

However, Cisar et al. do not teach the use of a conductive polymer composite as the substrate for the current collector. Bisaria et al. teach the use of an injection molded composition having excellent strength, stiffness and electrical resistivity as current collectors in the fuel cells. In one embodiment, the material is a thermoplastic liquid crystalline polymer resin combined with a conductive graphite filler. The conductive graphite filler is present in the composition at concentrations in the range of about 5 to 80%. See Column 4, Lines 37-51; Column 7, Lines 28-52. Therefore, it would have been obvious to one of ordinary skill in the art to use the

conductive polymer composite as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength, stiffness and electrical resistivity as current collectors in the fuel cells. Moreover, it is the position of the examiner that the filler particles (graphite) would inherently reside at the interface between the coating and the polymer composite substrate, given the high concentration of the graphite filler particles (5-80 wt%) in the composite. *A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference*. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claim 2, the filler particle comprises graphite powder and graphite fiber. See Column 7, Lines 43-52. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which contains graphite powder/fiber as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells.

With respect to claim 3, Bisaria et al. teach the use of graphite powder in the polymer composite. See Column 7, Lines 43-52. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which contains graphite particles as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells.

With respect to claim 6, Bisaria et al. teach the use of nickel-coated graphite fiber in the polymer composite. See Column 6, Lines 18-21. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which contains nickel-coated graphite fibers as the filler material, as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells.

With respect to claim 7, Bisaria et al. teach the filler material can be graphite fibers in length of 0.25" to 0.5". The thickness of the current collector is about 1 to about 3 mm (0.04-0.12 inch). As a result, there would be continuous fibers that extend through the thickness of the polymer composite. See Column 9, Lines 27-30, Column 10, Lines 1-6. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which contains continuous fibers extending through the thickness of the composite, as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit excellent strength and stiffness as current collectors in the fuel cells.

With respect to claim 8, Bisaria et al. teach the polymer composite as describe above can be used as current collector, flow field plate or bipolar plates in a fuel cell system. See Figure 1; Column 1, Lines 26-43. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite as a bipolar plate on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites can be used as either a current collector or a bipolar plate in the fuel cell system.

With respect to claim 11, Bisaria et al. teach the polymer is chosen from the group comprising polyester and poly(ester-amides). See Column 5, Line 54 to Column 6, Line 10. Therefore, it would have been obvious to one of ordinary skill in the art to use the conductive polymer composite, which is chosen from the group comprising polyester and poly(ester-amides), as the substrate of the current collector on the fuel cell of Cisar, because Bisaria et al. teach the polymer composites exhibit good corrosion resistance and electrical conductivity in a highly-corrosive environment.

With respect to claims 16,17, it is noted that these claims are product-by-process claims. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." <u>In re Thorpe</u>, 777 F. 2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). Since Cisar's surface coating on the conductive substrate is similar to that of the Applicant's, Applicant's process is not given patentable weight in these claims.

With respect to claim 32, Cisar et al. teach the use of noble metal coating on the conductive substrate. The coating itself is a continuous, oxidation-resistant and acid-resistant film. See Column 8, Lines 54-63.

Allowable Subject Matter

6. Claims 5,9,10,13,14,18,31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Claims 5,9,10 would be allowable because the prior art does not disclose or suggest the current collector comprises a metal substrate having a coating of the composite thereon. Claims 13,14,31 would be allowable because the prior art does not disclose or suggest the hyperconductive surface layer comprising a plurality of oxidation-resistant, acid-resistant, electrically conductive particles adhering to a surface of the composite confronting the media. Claim 18 would be allowable because the prior art does not disclose or suggest the film comprising a plurality of corrosion-proof conductive particles dispersed throughout an oxidation-resistant and acid-resistant polymer matrix.

Response to Arguments

7. Applicant's arguments filed on October 16, 2003 have been fully considered but they are not persuasive.

Applicant's principle arguments are

(a) Cisar's gold coating is needed to protect the titanium from corrosion whereas Braun's composite does not need a protective gold coating;

(b) Cisar et al. seeks to eliminate composite current collector from fuel cells and to replace them with all-metal current collectors;

(c) In Re Robertson is not applicable to 35 U.S.C.103(a) rejections that rely on a combination of references.

In response to Applicant's arguments, please consider the following comments.

(a) Cisar teaches the use of a light coating of noble metals on the substrates to insure a long service life and stable operation (no increments required in the stack potential to maintain constant current at constant temperatures over an extended time) in a corrosive environment. It is evident that the metal coating serves to enhance the fuel cell performance during operation in additional to provide oxidation protection over the substrate. Similar improvement can be expected when the metal coating is applied onto other type of current collector substrates, such as a conductive polymer composite as disclosed in the Braun or Bisaria reference. This can be further supported by the notion that the oxidation of titanium at the operation temperatures of PEM fuel cell (~120°C) is negligible. See Gas Corrosion of Metals (Mrowec et al., National Technical Information Service, Springfield, VA, pp.22-23 (1975)). Thus, the use of noble metal coating serves multiple functions and is not limited to corrosion prevention;

(b) in the introductory columns of the specification of Cisar et al, the focus of the invention is to replace carbon-based or graphite-based components with a structure of good electrical conductivity and thermal conductivity. As a result, Cisar et al. disclose the use of a foam metal current collector, such as a porous titanium sheet. Braun et al. teaches a thermally conductive and electrically conductive polymer composite structure for use in a highly corrosive environments, wherein the electrical conductivity of the resulting structure is improved as a

result of enhanced filler loading capacity of the composition. See Paragraph 9. Similarly, the composite current collector of Bisaria also exhibits good electrical resistivity along with good processibility and structural properties. See Column 4, Lines 37-51. It would have been obvious to one of ordinary skill in the art to substitute a conductive polymer current collector as disclosed by Braun or Bisaria for the foam metal current collector of Cisar, because of their respective advantages as discussed above. Therefore, the combinations of Cisar-Braun and Cisar-Bisaria are proper;

(c) the express, implicit, and inherent disclosures of a prior art reference may be relied upon in the rejection of claims under 35 U.S.C. 102 or 103. See MPEP 2112. "The inherent teaching of a prior art reference, a question of fact, arises both in the context of anticipation and obviousness." In re Napier, 55 F.3d 610, 613, 34 USPQ2d 1782, 1784 (Fed. Cir. 1995).

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dah-Wei D. Yuan whose telephone number is (571) 272-1295. The examiner can normally be reached on Monday-Friday (8:00-5:00).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan, can be reached on (571) 272-1292. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and After Final communications.

Patrick Ryan
Supervisory Patent Examiner
Technology Center 1700

Dah-Wei D. Yuan
January 8, 2004